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REPORTING OF INDUSTRIAL ACCIDENTS.

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In the United States we have been very careless of human life. We regarded with horror the death-roll of a destructive earthquake in Italy, but a single disease claims a larger number of victims in this country every year, most of whom might be saved. The Civil War was a terrible conflict but its destruction of human life was insignificant when compared with the killed and injured in modern industry, where, according to the estimate made by Frederick L. Hoffman for 1908, from 30,000 to 35,000 suffer fatal injury and 2,000,000 more are non-fatally injured every year.* Modern industrial prosperity has been achieved at the expense of human life and human development, to far too large a degree; but policies of conservation of human powers and energies are rapidly taking the place of the reckless disregard of the nation's vital forces. The public health movement is making swift progress under the strong impelling force of public opinion. Disease and injury are being prevented and society, so far as it cannot prevent accidents, is devising means to diffuse the risks of industry and lift the burdens too long carried by those least able to bear them.

State legislatures have been unusually active within the past two years in legislating upon employers' liability and in authorizing special commissions to investigate industrial accidents and their results with a view to the formulation of plans of compensation and insurance. At least thirteen states have actually enacted schemes and several other states have the matter under consideration. Large has been the fund of information gathered and analyzed by these state commis-

* U. S. Bureau of Labor, Bulletin No. 78, p. 458.

sions. At the same time the lack of complete statistics of accidents has been emphasized. It is recognized that wise legislation for the future is conditioned upon increasing completeness of information. It is the object of this paper to show what sort of data concerning industrial accidents are being collected by the various states; to suggest some of the purposes for which such data are essential, and to estimate how well the present facts meet our needs. From such a discussion it is hoped will result a clearer understanding of what facts ought to be collected in the future and how they ought to be gathered and presented.

THE GATHERING OF ACCIDENT STATISTICS BY STATE BUREAUS.

The desire for more complete information upon labor matters, with a view to the more just treatment of workers, gave rise to state bureaus of labor, established first in Massachusetts and at present found in more than thirty states of the Union. These offices have investigated a great variety of problems and have been assigned a wide range of duties. They have published the results of investigations relative to almost every condition surrounding the workingman at his work and in his home. Thus, have the bureaus become educational forces in the community, and, where efficiently managed, they have gathered and have classified materials upon the basis of which wise community action has been made possible. They have hastened remedial legislation and practical reforms in respect to employers' liability, regulating hours of labor, providing for the inspection of factories and mines, protecting the health and welfare of workmen, restricting the employment of women and children, establishing free employment bureaus, providing for the arbitration of labor disputes, and in relation to many other matters of vital concern to the working classes.

When Massachusetts passed the first 10-hour law in the country in 1874, the manufacturers of the state cried out against the alleged injustice because, as they maintained, it created unequal conditions of competition between themselves and their rivals in other states—a claim long familiar from

frequent repetition in connection with reforms advocated since that date in other commonwealths. The legislature directed the Massachusetts Bureau of Labor to investigate the facts of the claim. The result showed that under the operation of the new law the manufacturers of the state produced more goods per individual and per machine, and that the operatives in every respect were under better conditions than were those of surrounding states. This report put an end to serious attempts to repeal the 10-hour law.*

In 1904 the United States Bureau of Labor, in Bulletin 54, published a list of subjects of most vital interest to the laboring classes, which had been investigated by state bureaus of labor, and tabulated the number of state reports in which investigations on each topic had been found. Ten or more states had given attention to each of the following subjects—wages, hours of labor, strikes and lockouts, labor organizations, and relations between capital and labor. Only four states, up to that time, had attempted to collect data on industrial accidents. Since 1904 interest in the nature, extent, causes, and results of accidents has steadily increased. State departments of factory inspection and mine inspection have been created in many states in response to the demand for more careful supervision of working conditions by the state. Railroad and public service commissions are requiring reports of injuries occurring in connection with transportation. We are pausing to count the cost in human life of our phenomenal industrial progress, and to formulate policies which regard man as of more importance than wealth, where the two interests come into conflict.

Of the more than 30 states having bureaus of labor and statistics at least 21 are annually collecting, with varying degrees of completeness, statistics of industrial accidents. Some collect regularly, as required by law, only the record of injuries in mines; others only the record of injuries received in factories; and most states fail to collect for all industries.

The following composite tabulation for 19 states † will

* U. S. Bureau of Labor Bulletin, No. 54, p. 1090.

† Nineteen states were tabulated, viz.: Conn., Ia., Ill., Kan., Mass., Me., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis., W. Va.

show the nature of the inquiries made as to accidents in the various states and the points emphasized by the largest number of states. These facts have been ascertained, for the most part, by direct correspondence, and from an examination of the report blanks and the annual reports of the various state bureaus.

I. FACTS AS TO THE EMPLOYER.

1. Name (Conn., Ill., Kan., Me., Mass., Mich., Minn., Mo., N. J., N. Y., Ohio, Okla., Pa., Wash., Wis., W. Va.)
2. Address (Conn., Ill., Kan., Me., Mass., Mich., Minn., Mo., N. J., N. Y., Ohio, Okla., Pa., Wash., Wis., W. Va.)
3. Location of plant (Ill., Me., Mass., Minn., Mo., N. Y., N. J., Ohio, Okla., Pa., Wash., Wis., W. Va.)
4. Nature of business or industry (Conn., Ill., Me., Mass., Minn., Mo., N. J., N. Y., Ohio, Okla., Wash., Wis., W. Va.)
5. Number of employees (Mass.)
6. Name and address of manager in charge (Kan., Mo.)
7. Who was in charge where accident occurred? (Kan., Wash.)

II. FACTS ABOUT THE EMPLOYEE INJURED.

1. Name (Conn., Ill., Ia., Kan., Me., Mass., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis., W. Va.)
2. Address (Conn., Ill., Kan., Me., Mass., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Wash., Wis.)
3. Age (Ia., Ill., Me., Mass., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis., W. Va.)
4. Sex (Ia., Ill., Kan., Me., Mass., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Wash., Wis., W. Va.)
5. Conjugal condition (Ill., Me., Mass., Mich., Minn., Mo., N. J., Ohio, Pa., Wash., Wis., W. Va.)
6. Nationality (Ill., Me., Mich., Minn., N. J., Pa., Wis., W. Va.)
7. Understand English? (Wash., Wis., W. Va.)
8. In what language instructed? (Wis.)
9. Physical defects (eye or ear) (Wis.)
10. Was injured aware of danger? Instructions (Wash., Wis.)
11. Did injured make proper use of safety devices? (Wash., Wis.)
12. Occupation—Nature of work done (Ia., Ill., Kan., Me., Mass., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis., W. Va.)
13. How long in occupation? (Ill., Me., Mass., Minn., Ohio, Wash., W. Va.)
14. How long in establishment? (Mass., Ohio, W. Va.)
15. How long at work with or at the thing causing accident? (Ill., Me., N. J., Ohio, Wash., Wis.)
16. Time or piece-worker (Wash., Wis.)

17. Wages per day or week (Me., Mass., Minn., N. J., N. Y., Okla., Wash., Wis.)
18. Was injured insured? (Mo.)
19. Personal habits (W. Va.)

III. MACHINE OR THING CAUSING THE ACCIDENT.

1. What caused accident? (Conn., Ia., Ill., Kan., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis., W. Va.)
2. Name of machine or part causing accident (Conn., Ill., Kan., Mass., Mich., Minn., Mo., N. J., N. Y., Okla., Ohio, Wash., Wis., W. Va.)
3. In whose control at time of accident? (Wis.)
4. Was thing guarded at the time—if not, why? (Me., Mich., N. J., N. Y., Ohio, Okla., Wis.)
5. Describe guard or safety device (N. J., N. Y., Okla., Wis.)
6. How did the accident occur? (Kan., Mass., Minn., Mo., N. Y., Pa., Wash., Wis., W. Va.)
7. Suggestions to prevent similar accidents (Kan., Me., N. J., Wis.)
8. Have you taken precaution against repetition? (Ia., Kan., Me.)
9. Has any accident occurred under similar circumstances, at same place, or with same apparatus? (N. J.)

IV. RESPONSIBILITY FOR ACCIDENT.

1. Fault of employer, agent or machinery (Kan., Me., Minn., Neb., Ore., Wash.)
2. Wilful misconduct of injured (Me., Minn., Neb., Ore., Wash., Wis.)
3. Contributory negligence of injured (Kan., Me., Mich., Minn., Neb., Wash.)
4. Negligence of fellow-servant (Kan., Me., Minn., Neb., Wash.)
5. Natural hazard of industry (Me., Minn.)
6. Was safety device removed? By whom? (Wash.)
7. Names and addresses of witnesses to accident (Wash., W. Va.)

V. TIME AND CONDITIONS OF ACCIDENT.

1. Date, month and day (Conn., Ia., Ill., Kan., Me., Mass., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Wash., Wis., W. Va.)
2. Day of week (Kan., Neb., Ore., Wis.)
3. Hour of day (Conn., Ill., Kan., Me., Mass., Mich., Minn., N. Y., Ohio, Okla., Wash., Wis., W. Va.)
4. Hours of work before accident (Kan., Me., Neb., Ohio, Wis.)
5. Near window (Wis.)
6. Near artificial light (Wis.)
7. Condition of lighting (Wis.)
8. Crowding of workers on floor space (Wis.)

VI. NATURE AND EXTENT OF INJURY.

1. Exact nature of accident (Conn., Ia., Ill., Kan., Me., Mass., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Wash., Wis., W. Va.)
 - (a) Fatal, serious, severe, slight (Kan., Mich., Minn., N. J., Wis.)
(All distinguish between fatal and non-fatal)
 - (b) Internal (Minn.)
 - (c) Loss of hands, feet, eyes, limbs (Minn.)
 - (d) Sprains, dislocations, fractures, broken bones (Minn.)
 - (e) Lacerations, bruises, cuts, burns (Minn.)
2. Attending physicians. Names—Addresses (Minn., Mo., Wash., Wis.)
3. Has injured resumed work? What date? (Ill., Me., Mass., Minn., N. Y., Okla.)
4. Probable period of disability (Ill., Me., Mass., Mich., Neb., N. Y., Okla., Wash., Wis., W. Va.)
5. Caused permanent total disability (Kan., Mass., Minn., N. J.)
6. Caused permanent partial disability (Kan., Mass., Minn., N. J.)
7. Caused temporary disability (Kan., Mass., Minn., N. J.)
8. Loss of time in working days (Ill., Me., Mich., Mo.)
9. Loss in wages (Me., Ohio)
10. Dependents. Names—Ages—Relationship—Address—Earnings (Ill., Me., Mass., Minn., Mo., Ohio, Wash., Wis., W. Va.)

VII. CARE OF INJURED.

1. Medical and surgical attention since accident (Wis.)
2. Where was injured sent? (Mo., Okla., Wash.)

(Of course, employers' liability commissions require more details bearing upon compensation.)

From the table it will be observed that the states which collect accident statistics are unanimous in respect to one inquiry only—the name of the injured. All except one state require the date of the accident, and all except two states inquire as to the age and exact occupation of the injured, as well as the causes and nature of the injury. In addition to these questions, two thirds of the states seek information as to the name, address, location of the plant, and nature of the business of the employer; the address, sex, and conjugal condition of the injured; the name of the machine or part causing the accident, and the hour of day at which the accident occurred. Only one fourth of the states ask about the number of hours employed on the day of the accident. Somewhat

less than one half the states attempt to ascertain the nationality of the injured, how long they have been in the occupation, and how long at the particular operation causing the injury before the accident. But only three of the states inquire as to whether the injured understood English. About one third of the states inquire about the guarding of the thing causing injury and as to whether the employer admits that the accident was due to his fault or that of his agent, or whether he claims that it was due to the wilful misconduct or contributory negligence of the injured, or to the negligence of a fellow-servant. But only four states ask the employer to describe the safety devices or to make suggestions as to the prevention of future similar accidents. About one half the states inquire as to the probable period of disability, the average wage of the injured, and the details as to the number of dependents, while four states ask as to the loss of time in days and two the loss in wages, and four states attempt to define the extent of the disability, whether it is permanent or temporary, total or partial. Only one state asks as to physical defects of eye or ear which might have caused the accident, or as to the personal habits of the injured. The inquiries do not emphasize enough the person injured as to his liability to injury through his habits, his physical defects, his inability to understand English, his attitude toward safety devices, etc. Only two states ask for the names and addresses of witnesses to the accident and four require the names of the attending physicians. Only one state attempts in its schedules of inquiry to classify injuries in detail. Usually this is left to the one who tabulates the results. This analysis reveals a great variety of topics upon which information is sought but there is a great variety of combinations among the various states with far too little uniformity or agreement on the essentials. In order to agree on the essentials in such an inquiry there must be discussion and agreement upon the sort of problems, in the solution of which statistics may be useful. The latter part of this paper will be devoted to a discussion of some of those problems.

THE METHOD OF SECURING REPORTS AND THEIR SCOPE.

Having examined the nature of the inquiries actually made by the state bureaus in reference to accidents, certain further questions suggest themselves. Who fills out the report of accidents, the employer or an inspector? To whom is the report sent? Does it cover all industries or only a part? Are all accidents included or only those of a certain degree of seriousness, and is this specification the same for the various states? Is there a penalty for failure to report and how soon must the report be rendered?

There are two methods of making inquiries in an investigation: (a) by correspondence, mailing printed schedules to be filled out by a responsible person, and (b) personal inquiry by an officer or special agent. In accident reporting, as in most of the work of state labor bureaus, the former method is usually employed because of the expense attaching to the other method.

In the majority of cases the employer, or some one under his direction, fills out the schedules. In case any questions are not satisfactorily answered the blank is returned for further information, or an inspector of the State Department of Labor may be sent to investigate. When penalties have been imposed by statute for failure to report accidents it has resulted in substantial increases in the number reported, but it is more than likely that many accidents are not reported even in those occupations where the law requires reports, to say nothing of the many occupations, more or less dangerous, which are not required to report. In Wisconsin it is made the duty of physicians to report all accidents which occasion a disability of two weeks or more. The annual report for 1909-10 questions the completeness of these reports. The fact is cited that at least 50 fatal accidents were noted in a Milwaukee paper in one year which were not reported by physicians.* In Belgium physicians must report under penalty all accident cases treated, and the injured may not receive compensation until the physician has testified. This law has secured a more nearly complete record of accidents. A

* Fourteenth Biennial Report 1909-10, pp. 72-73.

similar plan should be adopted in our states, putting accidents on the same plane as certain diseases, especially in those states which have adopted insurance or compensation schemes. There will probably be far less difficulty in securing complete accident returns in the states which have these compensation schemes in operation. Private insurance companies possess a large fund of information concerning diseases and accidents. The state can greatly increase this kind of information and make it available for statistical purposes.

Besides the difficulties which arise from negligence or unwillingness to report injuries, there is more or less confusion among the states as to what department or bureau receives the reports. In some states the accidents in mines are reported to a separate bureau of mines; the accidents in factories to the department of factory inspection; the accidents on railroads to the railroad commission or public service commission; and the report of the department of labor attempts to combine all the data in its annual report. Sometimes the law requires duplicate reports to both the special bureau and the labor department.

The law in Illinois originally required that all employers report accidents causing death or 30 days loss of time to the Bureau of Labor. A later act, in 1910, required the report to the chief factory inspector from all employers under his jurisdiction, covering accidents causing 15 days loss of time. This later act practically repealed the part of the general act referring to factories. The chief factory inspector turns over his reports to the Bureau of Labor for tabulation and report. But this leaves part of the non-fatal accidents in Illinois collected on a basis of 30 days loss of time and part on a basis of 15 days loss of time. The result of this irregularity showed at once in the increase of accidents for the first year following the new method of reporting. The law further requires a report of accidents in mines to the mine inspectors, as well as to the labor department. A discrepancy occurs in the figures of the two departments.* Furthermore, the forms of report are not the same for both bureaus.

* Fourth Annual Report of the Illinois Bureau of Labor Statistics, pp. 7-8.

The New York Commission on Employers' Liability, in its second report, finds that it is impossible to state accurately the number of accidents reported in 1910, because each of the three offices receiving reports—the labor department, the public service commission of the first district, and that of the second district—has a different system of compiling statistics.*

In New Jersey the bureau of labor statistics, which does such excellent work in wage statistics, reports confusion in the records of accidents. The factory laws of the state require all factory owners to report accidents of a serious character to the factory inspection department. Only factory occupations and bakeries are included under this law. The Labor Department knows nothing of the observance of the law since no report has been made on the subject. In 1911 the legislature required all employers to report accidents to the commission on Employers' Liability, but the law also provides that these reports shall neither be published nor open to public inspection. The Labor Bureau itself collects reports of accidents from newspaper accounts and publishes these results as a part of its annual report. The Bureau has so improved this system that it feels safe in saying that 95 per cent. of the major accidents are traced, but this method cannot cover the important details of each injury, not to mention the minor accidents about which nothing is learned. But the Labor Bureau declares that the newspaper files are its only available source and it makes the best possible use of them.

Washington State has no law requiring employers to report accidents to the Labor Bureau. Each factory inspector is required to investigate and report to the labor office the facts as to accidents. Besides, the new state industrial insurance commission requires employers to report all accidents to it under penalty. That this situation is not satisfactory is evidenced by the seventh Biennial Report of the Bureau of Labor Statistics which declares, "The existing law for securing reports of accidents in mills and other industrial establishments is highly unsatisfactory and has failed almost entirely of accomplishing the purpose for which it was enacted. To be made properly effective, detailed reports of all accidents should be made to

* New York Employers' Liability Commission, Second Report, Note p. 2.

this bureau, immediately after their occurrence, and while the facts are fresh in the minds of the parties concerned.” * Enough has been said on this point to indicate the desirability of having one state bureau a clearing house and place of record for all data on accidents.

A most serious criticism against our accident statistics lies in the fact that they do not cover all dangerous occupations. The great industrial state of Pennsylvania has no adequate system of reporting accidents except in the one important industry of coal mining. The Bureau of Industrial Statistics receives some data on accidents but there is no legal compulsion and the particulars are not given in detail even when reported. The Bureau is hoping for larger authority in the future. The fatal and non-fatal mining accidents are reported to a separate department of mines by inspectors and a separate report is issued.

In New York State the law of 1910 extended the list of occupations in which accidents must be reported to include “building, construction, excavating, and engineering work.” During the first four months of its operation 2,530 accidents were reported, 75 of which were fatal. But this still does not include several more or less dangerous occupations, such as agriculture, water transportation, teaming, and stevedoring. In the Liability Commission’s first report, page 28, it was estimated, after a careful examination of the cards of coroners’ inquests and the records of emergency hospitals, that not more than half of the accidents of employment were at that time reported to any state department.†

Many other states require only part of the occupations to report accidents, but the states having liability commissions are requiring more complete records and we may expect, as more states adopt compensation laws, that the completeness of accident records will increase.

Somewhat more than one half the states requiring reports do not call for the return of all accidents in the given occupation but only those of a certain degree of seriousness. This degree of seriousness varies in the different states, from two

* Seventh Biennial Report of the Bureau of Labor Statistics and Factory Inspection, 1909-10, pp. 10, 11.

† New York Employers’ Liability Commission, Second Report, Note p. 2.

days or more loss of time, in Ohio, to 30 days loss of time, in Illinois. Three states have one week as the limit, one state has two weeks, and still another has 15 days for part of the accidents and 30 days for part. This variability destroys the value of the statistics for purposes of comparison.

Most of the states fix a time limit within which report must be made and prescribe a penalty of fine for failure to report. The period varies among the states from immediate to annual report. Two states require report at once, one within 24 hours, two within two days, one within three days, one within five days, one within eight days, one within 10 days, one within 15 days, and two within 30 days. A standardization of this period would be desirable since the accuracy with which certain questions could be answered varies with the time elapsing after the accident.

In concluding this part of our discussion it may be said that statistics are of most value when compiled and tabulated in such a manner as to be comparable over a period of years as well as at the particular period. It is certainly desirable to have the work of mine inspection and factory inspection delegated to bureaus of experts, but the records of accidents should be sent to one central office, on forms drawn up with as much uniformity as the nature of the occupations will permit, and tabulated from year to year according to the same general scheme.

For many states, which have not yet adopted compensation schemes, some method of securing more complete returns is especially needed. The accident and occupational-disease problem is one in which the local health and philanthropic agencies are vitally concerned, because upon these agencies falls the responsibility for taking care of the serious results of accidents. From the point of view of uniformity of results it is desirable to keep the gathering of accident statistics and the enforcement of law under the control of a state department, but from the point of view of direct and vital interest in the problem of accidents more responsibility ought to be placed upon the local health authorities. Accident disasters always stir up intense local feeling, but the great need is for more continuous local interest in building up a fund of infor-

mation which will show what the constant human costs in industry are and how present laws are affecting the situation. State labor bureaus ought to be able to co-operate with the local health authorities in securing reports of accidents and occupational diseases. A local clipping bureau, in certain industrial communities, supported jointly by local and state departments, could be used as a check upon the completeness of accident reports and thus secure better enforcement of the law. The local charitable agencies, likewise, could do much in securing prompt report of injuries. It would mean more liberal appropriations by the state for the protection of its working classes, but the expenditures of the local authorities, would most surely be returned many-fold in the decreasing public burden as a result of accident prevention and by the hastened formulation of adequate plans for meeting the burdens due to accidents.

PROBLEMS IN ACCIDENT STATISTICS.

1. *The Relation of Fatigue to Accidents.* Careful record of certain kinds of data should throw light upon this important problem. Exact knowledge concerning the nature of the business, whether seasonal or not, the hours of work, and speed of operation; as to the age, sex and experience of the worker; and as to the hours of the day, the day of the week, and the number of hours worked on the day of the accident is needed in order to form anything like correct conclusions concerning the influence of fatigue upon accidents. It is not enough to know the hour of injury without also knowing how many hours the person had been at work, because the working day does not begin at the same hour for all and the important fact relating to fatigue is the number of hours worked. But only one fourth of the states require this information. Only one third of the states seek information as to the experience of the worker, and none of them have attempted to record information as to the speed of operation at various periods of the day or the year. Yet, obviously, if we would draw accurate conclusions as to the effect of fatigue, we must have exact information on the other possible hypotheses to account for accidents.

Many statements are being made as to the influence of fatigue. At a recent meeting of the New York Academy of Medicine, held January 4th, Dr. Frederick L. Lee, in a discussion of a paper on occupational diseases, described the effect of fatigue upon the susceptibility to disease. He further declared that there was no doubt of the conclusion that many more accidents occur in factories and in occupations where the workmen are overworked and tired.*

The report of the New York Liability Commission declares that it was the common opinion of witnesses, although they had no figures to prove it, that excessive hours increase the number of accidents due to inattention on the part of the workmen in continuous industries like paper and pulp, and steel, where a two-shift system prevails.† Special investigations, such as are described in the report of the United States Commissioner of Labor on the strike at the Bethlehem Steel Works, published in 1910, give definite information concerning the long hours of labor. Of the 9,184 employees on the pay roll, 51 per cent. were found to be employed in occupations regularly requiring 12 hours or more per day as the regular working day, and 29 per cent. worked regularly seven days per week.‡ But Pennsylvania does not collect a regular and careful record of accidents in her great steel industry. It is, therefore, impossible to correlate accident statistics in Pennsylvania with long hours of work. It is left for special investigations such as the "Pittsburg Survey" to attack this problem. Usually, in our state reports, when the working day is discussed the average length of working day is given. We need more exact information upon the percentage of employees who work a given number of hours per day if we wish to throw light upon the relation of long hours to accidents.

The National Conservation Commission says, "The present working day from a psychological standpoint is too long, and keeps the majority of men and women in a continual state of over-fatigue . . . The manual worker through fatigue

* New York Times, Jan. 5, 1912.

† New York Employers' Liability Commission, Second Report, p. 22.

‡ Report of U. S. Bureau of Labor upon the Bethlehem Steel Strike, 1910, pp. 10-11.

caused by long hours is in a continual state of over-exertion.”* Elizabeth Butler found in Pittsburg that many canning factories work at night until 10 o'clock during the busy season—a working week of 72 hours. One manager admitted that his girls worked 75 hours a week for two months every year. Miss Butler found in another factory, where foot-press work was the chief type of labor, that the workers were sometimes forced to work 12 to 14 hours and “accidents are so frequent that the place has been characterized as a butcher shop.”† Miss Crystal Eastman quotes a yardmaster as follows: “Yardmen now usually work 12 hours, but when the yards are pressed, they often work the brakemen the 16-hour limit. And when a man works 16 hours at a stretch, it often means that he has been awake 18 or 20 hours, because there is a rule that a man must be called 2 1-2 hours before he goes on duty.”‡

Thus, suggestive material is not lacking from special sources but there is a very serious lack of definite statistical information covering all the points which relate to fatigue as a cause of accidents among large numbers of employees in various industries.

THE HOUR OF DAY AT WHICH THE ACCIDENT OCCURS.

For extensive data on this subject we must turn to foreign sources, but several of our states are now publishing material and special investigations are giving attention to the topic.

In the recent report of the Commissioner of Labor on the condition of women and child wage-earners, published as a Senate document in 19 volumes, one volume (XI) is devoted to the employment of women in the metal trades. A table on page 96 of this volume shows the tabulation, by hour of occurrence, of almost 15,000 accidents. Four sets of figures are used, collected by different agencies, in different parts of the United States, at different times, and covering different industries, each agency working independently. The results show a striking similarity and, in at least two particulars, a suggestive and rather unexpected distribution:—

* Quoted from *American Journal of Sociology*, Nov. 1911, p. 355.

† *Idem*, p. 356.

‡ *Idem*.

(a) The hourly proportion of accidents does not increase to the last hour of work, as the influence of fatigue might lead one to expect, but shows the greatest frequency about the middle of the working period.

(b) The proportion of accidents is generally greater for the morning than for the afternoon.

Every ten years, that is in 1887, 1897, and 1907, the German Imperial Insurance Office issues a special study of the facts regarding accidents compensated in the selected year. The last investigations, for 1907, are reviewed at length in Bulletin 92 of the United States Bureau of Labor. The results tabulated according to the hour of day agree in general with those just quoted from the report on the metal trades.*

However, it is not enough to record the hour of the accident. It is necessary to know also how long the worker was employed on the day of the accident. These figures few of our states require, and none of them have published. The German investigation does record this information, for 1907, in 79,791 accidents as follows:†

Length of Time Employed.	Per Cent.
Employed less than 1 hour.....	4.94
1 hour up to 2 hours.....	8.63
2 hours up to 3 hours.....	9.21
3 hours up to 4 hours.....	11.28
4 hours up to 5 hours.....	12.20
5 hours up to 6 hours.....	10.16
6 hours up to 7 hours.....	8.10
7 hours up to 8 hours.....	8.66
8 hours up to 9 hours.....	8.54
9 hours up to 10 hours.....	7.57
10 hours and over.....	10.71
	100.00

These figures corroborate the evidence from the data as to the hour of day. The expected increase in the proportion of accidents during the last hours of the day does not appear. The four last hours of work do not show a steady increase in accidents as the first five hours of the day do. The maximum for the day occurs at the end of the fifth hour of work.

Further evidence is contained in the first volume of the report on the condition of women and child wage-earners, describing accidents in the cotton mills as to the hour of occurrence.

* U. S. Bureau of Labor Bulletin; 92, table 6, pp. 29 *et seq.*

† *Idem*, p. 49.

The distribution is essentially the same as already noted.* The Minnesota figures for 1909-10 show a concentration of accidents in the morning at 10 and in the afternoon at 3 and a larger number in the morning.† The Wisconsin report for the same period shows a slightly later concentration in both morning and afternoon, but not enough different to change the significance of the figures already given.‡

From these facts it is apparent that the explanation of accidents is not simple,—that fatigue may be a very important cause but that other factors are of great importance and demand analysis. It would seem, since the largest number of accidents, according to all the tabulations, occur, not during the last working hours of the morning and afternoon, but at a considerable time before the noon hour and the closing hour, that speed is probably a very important factor. But we know very little about the speed at different seasons in specific trades, and we have still less statistical data on speed at various hours of the day. The accident rate per month would be useful if we could secure accurate returns concerning the number employed month by month, because it would indicate the effect of such seasons. At present, even if the records show a larger number of accidents at certain seasons, no definite conclusions can be drawn because larger numbers are employed at those seasons, and yet we do not know how many more are employed.

The German investigation previously cited tabulates the accidents according to the day of the week.§ Monday shows the largest proportion of accidents, decreasing until Thursday and rising again on Saturday to almost as high a point as Monday. The figures are given separately || for Monday morning and Saturday afternoon in order to emphasize more strongly the concentration at the beginning and the end of the week. The editors of the German report suggest the hypothesis that the high rate for Monday is due to an ill-used Sunday holiday. This is of considerable interest to social

* Vol. I. p. 395.

† Twelfth Biennial Report, Minnesota Bureau of Labor, 1909-10, p. 137.

‡ Bureau of Labor Statistics of Wisconsin, 1909-10, p. 78.

§ U. S. Bureau of Labor, Bulletin 92, pp. 23 *et seq.*

|| *Idem*, pp 29 *et seq.*

workers who are seeking to improve social and recreational opportunities for the working people, as well as to those interested in reducing accidents. Our states might easily extend their tabulations so as to include this information.

The previous discussion suggests that the explanation of accidents is not a simple task, and the examination of data bearing upon fatigue leads us further into other fruitful lines of inquiry. We ought not to be compelled to turn to foreign sources of information or to special studies over very limited areas for data concerning the fundamental facts concerning accidents which relate to this problem of fatigue. Many of our states are now striving to secure and keep on record the data needed as a basis for conclusions upon this subject.*

It can not be too strongly emphasized that the time at which accidents occur is of fundamental importance in understanding the problem. A very careful record of the time of day and of the number of hours worked before the accident occurred should be required by every state bureau charged with the collection of accident data. This information, to be most useful, must be gathered by industries and occupations, and a record made of the number employed at day and at night work in each employment. The numbers employed in a given industry by months is needed, in order to reveal seasonal changes and make possible the calculation of accident rates. From these data it will be possible to determine whether an accident in the given employment occurs in the course of the normal day's work or during overtime work; whether during the normal work season or during the rush season; whether at night or at day work. Besides, and of equal importance, it will be possible to calculate accident rates in the various employments for night and for day work, for rush seasons and for normal seasons, for the normal day and for the overtime working day. Then, if the various state bureaus will collect and publish these facts according to a uniform scheme, we shall be able to know the effect, in various states, of different regulations concerning the conditions of employment upon the accident rate.

* For a more detailed discussion of accident hours see *American Journal of Sociology*, Jan. 1912.—"The Relation of Fatigue to Industrial Accidents."—Part V, pp. 512 *et seq.*

2. *Experience of the Injured.* Data on this point should include a statement as to how long the injured person has been engaged in the particular occupation, in the particular establishment, and at the machine or operation by which he was injured. The hypothesis to be tested is that a certain time is needed to familiarize the worker with the details and secure for him the needed practice and correlation of movements, since each occupation and each establishment has special working conditions and special apparatus. Until this period has passed, he is more liable to accident.

Only one third of our states inquire as to the time at work in the occupation and with the specific machine or thing causing the accident, and only three states inquire how long the injured had been employed in the establishment. The German investigation for 1907 covers the facts as to length of time in the establishment and in the occupation.* The following table, for all industries, has been calculated from the German tabulations just cited, and shows the length of time in the occupation.†

Length of Time.	Total Number.	Average per Day.	Relative Number per Day.
Less than 3 days (excluding casual workers).....	2,284	761.3	2,080.1
3 days and under 1 week (6 days).....	1,050	350.0	956.3
1 week and under 1 month (26 days).....	4,288	214.4	585.8
1 month and under 3 months (78 days).....	5,960	114.6	313.1
3 months and under 6 months (156 days).....	5,092	65.3	178.4
6 months and under 1 year (312 days).....	5,705	36.6	100.0

The special report on the metal trades, just cited, tabulates the injuries to 1,102 press hands and to 1,603 workers in other occupations, as to the number of days employed at the particular machine before the accident. The following distribution is shown:—‡

* U. S. Bureau of Labor, Bulletin 92, pp. 47-48.

† Report on condition of women and child wage-earners in the United States, Vol. XI, Metal Trades. Footnote p. 92.

‡ Vol. XI, Metal Trades, p. 90.

AVERAGE NUMBER OF PRESS HANDS AND EMPLOYEES IN OTHER OCCUPATIONS
INJURED PER DAY AFTER BEGINNING WORK ON MACHINE.

Duration of Experience.	Press hands.	Others.	All.
1st day	329.00	131.00	460.00
2d day to end of 1st week	46.00	37.00	83.00
2d week to end of 1st month	7.00	10.00	17.00
2d month to end of 6th month	1.49	3.69	4.00
7th month to end of 1st year .....	.47	1.32	1.57

Another table on page 91 of this same volume tabulates these same accidents according to the seriousness of the accident and the length of time employed at the machine. These two tables taken together suggest that not only do more accidents happen, at least in many occupations, to the less experienced during the first days of their work, but the nature of the accidents during these first days is more serious.

The Minnesota report for 1909-10 tabulates the accidents according to the length of time in the employment, with the following results:—*

Duration of Experience.	Total Accidents.	Average per Day.
1 week or less (6 days)	488	81.3
1 week to one month (26 days)	787	39.4
1 month to 6 months (156 days)	1,120	8.6
6 months to one year (312 days)	386	2.5

This table supports the evidence from the other tables and indicates the desirability of gathering such data more widely among our states, and of combining the material by trades in order to discover differences among the various occupations.

The wide collection of statistics as to the experience of the injured worker will throw light upon the current idea that the experienced worker has by his familiarity with the dangers of his employment become careless and especially liable to accident. The tables, just presented, do not support this conclusion. The whole question of the worker's negligence as a cause of accidents is illuminated by such data and there is no

*Twelfth Biennial Report, Minnesota, Bureau of Labor, 1909-10, p. 136.

good reason why we should not collect them more widely. The figures suggest that at the very point where the worker is giving the closest possible attention the number of accidents is greatest. The report on the metal trades discusses in some detail the conception of the carelessness of the worker. Is it carelessness when the worker, having so coördinated his movements as to do with greatest precision operations calling for simultaneous movements of two sets of muscles, *i. e.*, hand and foot in stamping work, suffers accident to his hand because something interferes with the hand movement and the foot action, nevertheless, takes place on exact time? Is not the perfection of his work dependent upon a great deal of automatic action in coördinating with precision two different movements, especially at the high speed required by his employer? Is not his safety also dependent upon this very fact as shown in the tables presented? The very thing that makes him safer if both movements work unhindered, and when both movements are performed exactly together, makes the worker unsafe if one of the movements is hindered, because the other movement follows on time with inevitable and cruel precision. This can scarcely be called carelessness.

It is not meant to imply that there is not much recklessness on the part of workmen constantly exposed to danger, but it is questionable whether this very lack of a consciousness of danger is not as often the cause of safety as of accident, especially under the conditions of speed and high tension in modern industry. It is maintained that the facts should be collected for each industry and tabulated separately in order to show the situation in each occupation, because in any movement for the prevention of accidents each occupation deserves to be treated according to its peculiar dangers and special problems.

3. *Nature and Duration of the Disability.* In order to understand the nature and extent of the burden imposed by accidents accurate information is necessary as to whether the accident resulted in temporary or permanent, partial or total disability; as to what loss of time and wages was involved, and as to the facts about those dependent upon the injured worker.

In order to apply the principles of insurance in meeting this burden, whether a plan be devised by the state, or by the employers in a particular industry, or by a single employer, exact information is needed in regard to the facts referred to, for all the workers suffering accidents. By application of the law of averages it will then be possible to create a fund sufficient to compensate those who suffer accident or their dependents. As long as there exists so little complete and accurate statistical data upon the number and consequences of industrial accidents, the cost of insurance or compensation schemes will remain a matter of conjecture.

The most recent scientific basis for a scheme of compensation has been worked out in the brewing industry. For almost two years a committee representing the Brewers' Association and the Union of Brewery Workers of America has been at work on this scheme of accident compensation and old-age pensions. As a basis for this plan, an investigation of the accidents in the brewing industry was considered imperative. Reports were received from 16,374 workmen concerning the details of accidents. Edward B. Phelps, of the American Underwriter, tabulated the results and formulated estimates as to the cost of the scheme based upon the facts of experience.* Under the terms of this plan a fund will be created, contributed to by both employer and employee, to compensate for accidents. But how large a fund would be needed, and therefore, what amount each should contribute could be decided only after the appeal to the statistical facts of past experience in that industry.

For no other large industry, except for interstate railroads, have the facts as to accidents been collected, irrespective of state lines.† Most of the large industries of the country are carried on in more than one state. If these states require reports as to accidents at all, there is little uniformity in the data reported. The results are not comparable and the entire burden of accidents in any large industry as a whole is unknown.

* The Survey, Jan. 20, 1912, pp. 1617 *et seq.* Report published by Edward B. Phelps separately.

† The author is informed that the United States Bureau of Labor, in connection with its investigation of the steel industry, has gathered data on accidents in that industry which may be published at a later date.

Only one fifth of the states, which require reports, make inquiry as to whether the disability is permanent or temporary, total or partial, and what loss in time is involved. About one half ask as to the probable period of disability.

The German special investigation for 1907 presents the details for accidents compensated in 1904 and follows the changes through four successive years in reference to these same cases.*

INDUSTRIAL ACCIDENT ASSOCIATIONS—1904, 65,205 CASES.

Year.	Per cent. of Injured Whose Injuries Resulted in:			
	Death.	Total Permanent Disability.	Partial Permanent Disability.	Temporary Disability.
1905.....	7.63	.93	44.27	47.17
1906.....	7.81	.80	41.12	50.27
1907.....	7.96	.78	39.00	52.26
1908.....	8.06	.81	37.40	53.73

This table is further elaborated under the heads of partial permanent disability and temporary disability to show, for each class, what proportion sustain no loss, under 25 per cent., 25 to 50 per cent., 50 to 75 per cent., and 75 to 100 per cent. in earning power. Detailed tabulation for each industry of these same facts is made. Such a record throws much light upon the nature and extent of the burden imposed by industrial accidents.

Obviously, the great need everywhere, and especially among our many state bureaus, is for a definition of these terms so that it will be clear where a given accident ought to be classified, and in order that the results from many states may be comparable, when, for instance, we wish to bring together the data for a great industry operating in several states. That this is one present difficulty with our statistics on this subject will appear from the material about to be presented.

* United States Bureau of Labor, Bulletin 92, pp. 70 *et seq.*

Year.	Total.	Per Cent. Deaths.	Injuries.		Per Cent. Temporary.
			Per Cent. Permanent.	Per Cent. Serious, Prob- ably Permanent.	
1907.....	19,431	1.77	14.07	10.57	73.59
1908.....	14,455	1.77	12.10	11.41	74.72
1909.....	16,830	1.50	9.57	12.64	76.29
1910.....	25,390	1.39	8.00	9.79	80.82

The foregoing table of accidents reported to the New York Department of Labor are distributed, as to the seriousness of the injury, as follows:* These accidents are further analyzed by mechanical cause and degree of seriousness.† The above table, for all industries reporting accidents in New York State, indicates that to the increasing total of accidents the deaths and more serious injuries bear a decreasing proportion. The proportions vary among the different industries and this in itself is important information in formulating protective policies and in estimating the burden of accidents. Unlike the German tabulation, the table just presented does not analyze the degree of loss of earning power within the groups of permanent and temporary disabilities.

When we consult other state reports we find different methods used to present this same class of facts. The Wisconsin report for 1909-10 first analyzes the accidents according to whether the injury was fatal, permanent, or temporary, but does not follow the plan of the New York report in dividing the permanent into the definitely permanent and the serious and probably permanent. A second table distributes the accidents according to whether they were fatal, serious, severe, or slight, but does not distinguish between a serious permanent injury and a serious or severe temporary injury.‡ Thus, the difficulty with this presentation lies in the fact that the temporary and permanent injuries are not distributed according to their seriousness and effect upon earning power which is the matter of greatest importance. A slight injury

* New York Liability Commission—2d Report, p. 2, for basis of calculations used in this table.

† New York Liability Commission—2d Report, table opposite p. 2.

‡ Bureau of Labor Statistics of Wisconsin, 1909-10, pp. 75-76.

may be permanent in its effects upon earning power, or a severe injury may be temporary in its effects.

It is evident that there is no uniform definition of terms explaining the nature and duration of disability from accidents or its effect upon earning power. Nor is there a uniform method of presenting results so as to render them comparable.

Over half the states ask for the probable period of disability. These are predictions and are, therefore, very liable to error, especially where the employer fills out the report. Some states require a supplementary report at a later date to complete and correct this information. The Wisconsin report for 1909-10 distributes the accidents according to the probable period of disability, the reports having been sent in by physicians:— *

Duration.	Number.	Per Cent.†
Not over 2 weeks.....	1,618	32.4
Over 2 weeks, not over 1 month.....	2,129	42.6
Over 1 month, not over 2 months.....	749	14.9
Over 2 months, not over 3 months.....	180	3.6
Over 3 months, not over 6 months.....	85	1.7
Over 6 months.....	11	.2
Fatal.....	135	2.7
Not predicted.....	96	1.9
	5,003	100.0

It will be observed that about three quarters of the accidents are shown to involve a probable disability of less than one month. The Minnesota report for the same period tabulates the probable disability for specific kinds of injuries only.‡ The need is for a more uniform and definite meaning of terms in the schedule of inquiry and for some clearer understanding of the purposes of tabulation and a uniform method of presentation so as to render the results comparable.

4. *The Mechanical Cause of Accident and Nature of Injury by Industries.* From the point of view of the prevention of accidents it is very necessary to have exact information on these points. Most of the states require exact statements in

* Bureau of Labor Statistics of Wisconsin, 1909-10, p. 77.

† This percentage distribution is greatly affected by the exclusion of trivial accidents.

‡ Twelfth Biennial Report Minnesota Bureau of Labor, 1909-10, pp. 129 *et seq.*

detail, but the one who fills out the report states the facts in his own way, and it is left to the person who tabulates the results to classify them as best he can in preparing the annual report and in keeping the records. This accounts for the variety of classifications and tabulations in state reports.

The great need here is for some more uniform classification of the kinds of injury and the mechanical causes of injury for each industry in order that the facts collected in one state may readily be compared with those for another state and that the reports for successive years in the same state may be comparable. Just as the classification of the causes of death has been worked out according to which all deaths are grouped, from whatever community reported, so in each industry the employer or the physician ought to be able to classify the accidents reported according to a uniform grouping. Thus, a specific accident would mean the same from whatever shop or community reported. These classes of injuries and mechanical causes should be based upon past experience in recording accidents and always with a view to the practical purposes to be served by the results. At present only one state attempts to classify the nature of the injury in the report blank itself.

The New York Liability Commission, in its second report, opposite the second page, presented a cross-classification in detail, of cause and nature of injury, in the case of accidents reported in 1907-10. This table will illustrate the meaning of what has just been suggested. If this proves a good classification, then the form should be preserved from year to year and should be adopted in other reports. If it is not the most useful then it should be discarded in favor of a more useful classification. The contention is for some recognized standard form. The table is as follows, both parts belonging to the same table:—

Cause.	Grand Total.	Temporary.		Serious, Prob- ably Permanent.	Deaths.
		Total.	Fractures.		
Mechanical power ..	33,990	21,415	845	5,391	565
Heat and electricity ..	6,410	5,417	22	552	302
Fall of person	6,165	5,543	534	292	129
Injured by weights ..	16,969	14,963	729	1,099	145
Flying objects	3,088	2,502	8	424	1
Vehicles and animals ..	1,390	1,197	86	119	15
Miscellaneous	8,094	7,420	115	429	49
Total	76,106	58,457	2,339	8,306	1,206

Cause.	Permanent Injuries.						
	Loss of One or More				Internal.	All Others.	Total.
	Limbs.	Hands or Feet.	Fingers.	Eyes.			
Mechanical power ..	153	155	5,337	62	147	765	6,619
Heat and electricity ..	5	5	7	49	9	64	139
Fall of persons	3	...	17	4	72	105	201
Injured by weights ..	12	4	393	1	142	207	759
Flying objects .....	...	...	3	133	1	24	161
Vehicles and animals ..	2	2	24	...	11	20	59
Miscellaneous	1	...	95	5	24	71	196
Total.....	176	166	5,876	254	406	1,256	8,134

Each of these main causes is further subdivided in the extended table into detailed causes. For instance, Mechanical Power is subdivided into: (1) Transmission of power, (2) Conveying and hoisting machinery, (3) Woodworking machinery, (4) Paper and printing machinery, (5) Textile machinery, (6) Leather-working machinery, (7) Metal-working machinery, (8) Machinery for polishing, (9) Machinery used in bakeries, etc., and (10) Machines not elsewhere specified. These sub-groups are each tabulated according to the cross-classification of the nature of the injury. Each main mechanical cause given in the table is subdivided in like manner.

The Wisconsin Report for 1909-10, pages 80-82, uses the same classification of mechanical causes in detail, but combines with these divisions in cross-classification the various industries instead of the kinds of injuries as the New York tables do. The Wisconsin Report thus secures a total under each industry for the various detailed causes, but not for each kind of injury.

The Minnesota Report for 1909-10 classifies the part of the body injured in a cross-classification with the nature of the injury (p. 127), and then classifies the nature of the injury by industries (p. 131), and finally, the mechanical causes in a cross-classification with the nature of the injury (p. 143). But the classification of mechanical causes here used is not the same as that used in the New York and Wisconsin reports. Furthermore, the headings describing the nature of the injury in the three tables (pp. 127, 131 and 143) in the Minnesota report itself are not exactly the same.

From the point of view of the enforcement of existing laws for the safety of employees exact information is desired about the particular shop or process; from the point of view of the enactment of new laws the important information should relate to certain trades or occupations or processes especially dangerous, concerning which the state may elaborate more specific safety provisions; and from the point of view of the conservation of the nation's working force the data from the various states should be comparable.

5. *Sex, Age, and Conjugal Condition of the Injured.* All except two of the states, requiring accident reports, ask as to the sex and age, and two thirds of them inquire as to the conjugal condition of the injured. It is important that the injured be classified by sex in certain occupations in order to throw light upon the problem of the protection of women workers and the regulation of their working hours. Of course, the absolute numbers of accidents among male and female employees mean nothing without taking into consideration the number of each sex employed and working out a rate of accidents. On this account there is need that a careful record of the number of employees in each establishment throughout the state, classified by age, sex, and conjugal condition, be kept in the labor office or in the bureau of state statistics. It would be desirable if this record of employees should be reported each month, in order that more exact information might be available concerning seasonal trades, unemployment, and accidents at certain rush seasons. It would then be possible to determine rates of accidents, by sex and age groups, for one shop singly, or for an entire indus-

try. In order to understand the relative danger of various operations within a shop or industry we should know the numbers employed at those processes as well as the absolute number of accidents.

The Wisconsin Report, for 1909-10, classifies accidents by sex as follows:—*

	Number Injured.	Per Cent.
Male.....	4,877	97.50
Female.....	124	2.47
Not stated.....	2	.03
	<hr/> 5,003	<hr/> 100.00

This table would mean much more if the number employed and the accidents, male and female, were stated by industries, and it would mean still more if these facts were stated by certain processes or operations within the industry. This would involve a uniform classification of processes or operations within an industry so that each employer would know how to classify his workers and the accidents occurring in connection with those processes.

The special investigation of the metal trades, previously cited, calculates accident rates for men and women in 16 establishments employing 21,069 workers.† Where an especially high rate was found it was traced to a particular process and there the source of danger could be located. When the occupations in which each sex is engaged are considered it is shown that the males are found in the more dangerous occupations. This special investigation showed generally a smaller accident rate for women than for men and where a higher rate in a particular establishment was observed it could be explained by the employment of women in large numbers upon stamping presses.‡

The age of the injured may affect the accident problem either from the point of view of liability to accident, or from the point of view of the results of the accident and the

* Bureau of Labor Statistics, 1909-10, p. 74.

† United States Bureau of Labor, Twenty-fourth Annual Report, Volume XI, Metal Trades, pp. 75-76.

‡ *Idem*, p. 77.

compensation needed to fairly meet the losses incurred. It may prove a factor to be taken along with inexperience as a cause of accidents. This view is not supported for the metal trades, where, according to the special investigation, page 93, the average age of males injured during the first day of experience, was shown to be even slightly higher than for those injured after longer experience.

If we are able to judge correctly the extent of the burden imposed by accidents, it is important to know at what time of life the rate is the highest. The Minnesota report for 1909-10 classifies 7,826 accidents by age groups:—*

Age.	Per Cent.
14 to 16.....	.89
17 to 21.....	16.24
22 to 30.....	44.54
31 to 40.....	23.00
41 to 50.....	10.63
51 to 60.....	3.90
60 and over.....	.80
	<hr/> 100.00

The most obvious criticism against this table is the sudden change in the age interval, 3 years, 5 years, 9 years and 10 years. The sudden change from 5 to 9 years in the third interval exaggerates the percentage of accidents occurring at that interval. In this choice of interval there should be uniformity in the length of the interval itself in order to render the per cents. comparable and to determine which age group suffers the largest percentage of accidents and how much larger. There should be uniformity in successive reports and among different states so as to render the data comparable.

Another important inadequacy lies in the fact that the numbers employed at each age group are not given. No accurate conclusions are possible as to the relative liability of various age groups to accident until we know the number employed at each age and calculate a rate of accidents upon that basis.

Such a table as the one just presented does show that 83.78 per cent. of accidents reported in Minnesota occurred between the ages of 17 and 40, which is in the prime of life, at the period of greatest earning power, and at the period when

* Twelfth Biennial Report, Minnesota Bureau of Labor, p. 133.

serious or permanent disability is likely to cause the heaviest burden in the support of dependents.

The Wisconsin report for 1909-10, page 75, classifies 4,851 accidents by age-groups and states the numbers employed at each age group, which allows the comparison of the number of accidents with the number employed. In this respect, it is an improvement over the table just given from the Minnesota report, but the age intervals of the Wisconsin table are not at all the same as for the Minnesota table and their length is not at all uniform. The first interval is 5 years, the second 10 years, the third 15 years, and the fourth 20 years, which entirely distorts the percentages for purposes of comparison between age groups, as well as for comparison between the two states.

This classification of the injured by age groups would prove more suggestive if extended to particular industries, for instance, those industries which employ a large percentage of women or young persons, and to certain processes and operations recognized as especially dangerous. The presentation of convincing evidence upon the matter of accidents might result in revolutionizing the methods of introducing new workers into dangerous employments, not alone from motives of humanity but also from the motives of efficiency and self-interest on the part of the employer.

The conjugal condition of the injured is chiefly important in two directions. Classification by industry and conjugal condition might indicate whether marriage tends to make the worker more careful in his operations or more cautious in his choice of employment. To draw more accurate conclusions it would be necessary to know the conjugal condition of the workers as a whole in order to calculate rates of accidents for married and single in various establishments and occupations.

Of still greater practical importance is the relation of the injured worker's conjugal condition to the burden which accident brings and to the problem of the support of dependents. About half the states inquire as to the dependents of the injured and in the states with compensation schemes in operation this information can be secured more accurately. But in all the states it is desirable to collect such information in order to

better understand the results of accidents and the need of an adequate plan to meet fairly their consequences.

There remain many other problems of industrial accidents in the solution of which statistical data serve a useful purpose. A more careful inquiry is needed concerning the influence of nationality, physical defects, and personal habits upon liability to accident, and concerning the responsibility for accidents, whether due to the fault of employer or worker or due to the hazard of industry. Thus far in the discussion of accidents attention has been largely centered upon the large absolute numbers of injuries and their terrible consequences. This method has served and is serving a most useful purpose in rousing public opinion, but a careful and scientific knowledge of accidents involves the calculation of accident rates. Therefore, we must strive for the necessary data for the calculation of rates of accidents.

In the first part of this discussion we have reviewed the kind of inquiries made concerning industrial accidents in the various states and have noted how many states make each inquiry, with a view to showing the sort of information upon which most of the states agree, and with the further purpose of indicating the need for greater uniformity in schedules and for agreement on the essential facts required in reference to accidents. The method of collecting the information, and the scope of the inquiries show a serious lack of complete data and the lack of a uniform scheme of record and presentation. Much of our scanty material is not comparable from year to year or among the various states.

A clearer understanding of the nature of the problems, in the solution of which statistical data are essential, has been the aim of the second part of this paper. Such an understanding is preliminary to the collection of the facts themselves and should be our guide as to what facts to collect in the future and how to collect and arrange them.